Web Appendix: Economic Insecurity and Deaths of Despair in US counties

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Web Appendix 1. Development of Economic Insecurity Index

We developed the economic insecurity index as part of a larger project on childhood obesity in Pennsylvania [1]. Therefore, we first developed this index in the 320 counties in in Pennsylvania and the surrounding states of Maryland, Delaware, New Jersey, New York, Ohio, and West Virginia. Indicators of economic insecurity were collected from federal agencies such as the Census Bureau, Bureau of Labor Statistics, state and local government databases, and privately operated databases.

We began the modelling process with eight indicators: percent of those not in the labor force, percent unemployed, percent of household income spent on rent (among renters only), percent of household income spent on housing costs (among home owners only), number of permits for construction of new residential buildings, percent of housing units occupied by the owner, percent of those employed in the service sector, and percent of those with a subprime credit rating (credit score below 660). After exploratory data analyses, all variables were deemed appropriate to include in the model as continuous measures.

Confirmatory factor analysis was used to evaluate our hypothesized measure of economic insecurity. All models included only one domain. Through the iterative CFA process, 3 indicators were dropped due to poor model fit: percent of housing units occupied by the owner, percent of income spent on housing costs among home owners and new permits for residential construction. Standardized factor scores (mean 0.0, standard error 1.0) were calculated for each county. A summary of the indicators used in this model is included in Appendix Table 1. Model fit statistics are provided in the first column of Appendix Table 2.

We evaluated the validity of this index in several ways. Because there is no gold standard measure of economic insecurity, we compared our index to the unemployment rate, a commonly used proxy for economic insecurity. Specifically, we examined the correlation between these two measures and all-cause mortality in 2001 as well as the top 3 causes of mortality in 2001: heart disease, cancer, and stroke. We hypothesized that heart disease would have the strongest correlation with economic insecurity because of previous work connecting unemployment and economic conditions to heart disease [2,3]. Second, we examined the correlation between economic insecurity and measures of socioeconomic deprivation and social disruption. Lastly, we examined the correlation between economic deprivation and demographic factors such as racial composition, median age, and population density, to determine if demographic trends were driving economic insecurity.

For this manuscript, we expanded upon the previously created measurement model to apply the measurement structure to all counties in the US (fit statistics for these models provided in columns 2 and 3 in Appendix Table 2).

Web Table 1. Indicators of County Economic Insecurity

Indicator	Source	Definition	Low Tertile, Mean (SD)	Medium Tertile, Mean (SD)	Highest Tertile, Mean (SD)	All counties, Mean (SD)
Unemployment (%)	2000 Census	Employment status for total population 16 years and over	2.3 (0.6)	3.2 (0.5)	4.8 (1.8)	3.4 (1.6)
Not in labor force (%)	2000 Census	Not in labor force for total population 16 years and over[1]	33.7 (4.9)	39.1 (5.2)	44.3 (6.5)	39.0 (7.1)
Percent of income spent on rent (%)	2000 Census	Median gross rent as a percentage of household income in 1999 among specified renter-occupied housing units paying cash rent	22.0 (3.0)	23.4 (2.5)	24.8 (3.0)	23.4 (3.1)
Employed in service occupations (%)	2000 Census	Percent of the employed civilian population 16+ years in service occupations[2]	14.4 (2.6)	15.7 (2.7)	17.1 (3.3)	15.7 (3.0)
Subprime credit rating (%)	Equifax Consumer Credit Panel/Federal Reserve Bank of New York	The percent of nationally representative sample with a credit score below 660 [4]	26.7 (6.8)	32.5 (7.0)	36.9 (8.0)	32.0 (8.4)

[1]Among the population of those 16 and older, individuals are classified as in the labor force (i.e. employed or unemployed but actively seeking work) or not in the labor force. Those not in the labor force include those who have not actively sought employment in the last month, students, homemakers, retired workers, those who are institutionalized, and (during the off season) seasonal workers.

[2] Service occupations includes healthcare support, protective services, food preparation and serving, maintenance/grounds cleaning, and personal care and service occupations (52).

Web Table 2. County Economic Insecurity Model Fit Statistics

All models are best-fitting models per year, evaluated against fit statistic guidelines provided by Hu and Bentler: CFI of 0.95 or greater, RMSEA less than 0.06, and SRMR less than 0.08 [5]. The latent variable was constrained at 1. All models contain the same 5 indicators: percent not in labor force, percent unemployed, percent of income spent on rent, percent employed in service job, percent with subprime credit rating.

	1) PA and contiguous states, 2000[1]	2) All counties, 2000	3) All counties, 2010
Free parameters	15	17	17
RMSEA	0.109 (0.068, 0.155)	0.133 (0.117, 0.151)	0.110 (0.094, 0.128)
CFI	0.961	0.931	0.962
TLI	0.922	0.770	0.872
SRMR	0.033	0.038	0.031
Correlated error terms[2]	None	2	2

[1] 7 states, 320 counties: PA, MD, DE, NY, NJ, OH, WV.

[2] Correlated measurement errors include not in labor force with unemployment and not in labor force with service jobs.

Web Appendix 2. Secondary Analyses

Web Table 3. Association between category of change in county economic insecurity from 2000 to 2010 and change in deaths of despair mortality from 2001-2005 to 2011-2015 among non-Hispanic white persons aged 45-54 (N=2315 counties)

	Model 1	Model 2	Model 3	Model 4
Relative Rate of Deaths of Despair Mortality in Baseline Period, 2001-2005				
Stable low	1.00 (REF)	1.00 (REF)	1.00 (REF)	1.00 (REF)
Stable medium	1.23 (1.18, 1.30)	1.22 (1.16, 1.29)	1.24 (1.18, 1.30)	1.22 (1.16, 1.29)
Stable high	1.51 (1.41, 1.62)	1.49 (1.39, 1.60)	1.53 (1.43, 1.63)	1.49 (1.40, 1.59)
Increasing	1.30 (1.22, 1.38)	1.29 (1.22, 1.37)	1.30 (1.22, 1.38)	1.29 (1.22, 1.37)
Decreasing	1.31 (1.24, 1.39)	1.30 (1.22, 1.37)	1.32 (1.24, 1.40)	1.30 (1.22, 1.38)
Relative Rate of Change in economic insecurity between 2001-05 to 2011-15				
Stable low	1.00 (REF)	1.00 (REF)	1.00 (REF)	1.00 (REF)
Stable medium	1.02 (1.00, 1.04)	1.02 (1.00, 1.04)	1.02 (1.00, 1.04)	1.02 (1.00, 1.04)
Stable high	1.00 (0.98, 1.02)	1.00 (0.98, 1.02)	1.00 (0.98, 1.02)	1.00 (0.98, 1.03)
Increasing	1.00 (0.98, 1.03)	1.01 (0.98, 1.02)	1.01 (0.98, 1.03)	1.01 (0.98, 1.03)
Decreasing	1.01 (0.99, 1.03)	1.01 (0.99, 1.03)	1.01 (0.99, 1.03)	1.01 (0.99, 1.04)
Place type				
Large metro areas	-	0.97 (0.93, 1.01)	-	0.97 (0.93, 1.01)
Medium/small metro	-	1.00 (REF)	-	1.00 (REF)
Rural areas	-	1.02 (0.99, 1.05)	-	1.02 (1.00, 1.05)
Racial composition				
Percent Black	-	-	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)
Percent Hispanic	-	-	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)

Estimates in this table are from mixed effects log-linear regression models with random effects for state, county, and time period (2001-05, 2006-10 and 2011-15). In addition to the variables listed in the table, all models were also adjusted for the percent of the county in each time period that was male, and the percent of the county in each time period age 45-49 and 50-54. The outcome, all-cause mortality among 45 to 54 year olds, was log-transformed. Coefficients in this table are exponentiated and represent the relative change in all-cause mortality compared to the reference group.

Web Table 4. Association between category of change in county economic insecurity from 2000 to 2010 and change in deaths of despair mortality rate from 2001-2005 to 2011-2015 in persons aged 45-54, in counties with nonmissing mortality in non-hispanic white persons (N= 2139)

	Relative Rate (95% CI)
Deaths of Despair Mortality in Baseline Period, 2001-2005	
Stable low	1.00 (REF)
Stable medium	1.20 (1.08, 1.34)
Stable high	1.55 (1.29, 1.85)
Increasing	1.23 (1.09, 1.40)
Decreasing	1.29 (1.18, 1.41)
Change in economic insecurity between 2001-05 to 2011-15	
Stable low	1.00 (REF)
Stable medium	1.04 (0.99, 1.09)
Stable high	0.99 (0.94, 1.03)
Increasing	0.99 (0.93, 1.06)
Decreasing	1.00 (0.96, 1.04)
Place type	
Large metro areas	1.11 (1.01, 1.21)
Medium/small metro	1.00 (REF)
Rural areas	1.12 (1.05, 1.18)
Racial composition	
Percent Black	0.99 (0.99, 0.99)
Percent Hispanic	1.00 (0.99, 1.00)

Among counties with non-missing deaths of depair for white persons (those counties in Appendix Table 2). Patterns of mortality are similar to those seen in main models (Table 2).

Web Table 5. Association between continuous change in county economic insecurity from 2000 to 2010 and change in deaths of despair 2001-2005 to 2011-2015 among counties with non-missing mortality data (N=2856 counties)

	Relative Rate of Deaths of Despair
Baseline economic insecurity, 2000	1.19 (1.17, 1.21)
Change in economic insecurity, 2000-2010	1.07 (1.05, 1.09)
Metropolitan	0.99 (0.96, 1.03)
Medium Metro	1.00 (REF)
Rural	1.03 (1.00, 1.06)
Black, %	0.99 (0.99, 0.99)
Hispanic, %	1.00 (1.00, 1.00)

This model is identical to model 4 in main table 2, except that the exposure, economic insecurity, is modelled in its continuous form. Additional covariates not listed in this table include percent male and median age. Among counties that were of average economic insecurity in 2000, the rate of deaths of despair increased 7% between 2001-05 to 2011-15.

References

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